Buffer Solutions, Titration and Indicator:

1. $pOH = 7 - 0.5\ pK_a + 0.5\ pK_b$ is true for aqueous solution containing which pair of cation and anion

(A) $C_6H_5NH_3^+$, CH_3COO^- (B) NH_4^+, F^-

(C) Both (A) and (B) (D) None of these

2. If pK_b of weak monoacidic base > pK_a of weak monobasic acid, then the solution of the salt of weak acid and weak base having equal concentrations of cation and anion will be

(A) Neutral (B) Acidic (C) Basic (D) Cannot be predicted

3. The pH of an basic buffer solution is

(A) > 7 (B) < 7 (C) = 7 (D) Depends upon K_b of base

4. Choose the correct statement(s) :

(A) pH of acidic buffer solution decrease if more salt is added

(B) pH of basic buffer solution increases if more base is added

(C) Both (A) and (B)

(D) None of these

5. The pH of buffer of $NH_4OH + NH_4Cl$ type at 25°C is given by

(A) $pOH = pK_b$ (B) $pH = pK_b + \log [Salt]/[base]$

(C) $pH = 14 - pK_b - \log [Salt]/[base]$ (D) $pH = 7 - pK_b - \log [Salt]/[base]$

6. Which may be added to one litre of water to act a buffer

(A) One mole of CH_3COOH and one mole of NaOH

(B) One mole of NH_4Cl and two mole of NaOH

(C) One mole of $NaNO_3$ and one mole of HNO_3

(D) One mole of CH_3COOH and 0.5 mole of NaOH

7. Which of the following pairs constitutes a buffer ?

(A) HNO_3 and NH_4NO_3 (B) NaOH and NaCl (C) HNO_2 and $NaNO_2$ (D) HCl and KCl

8. To prepare a buffer solution of pH = 4.04, amount of Barium acetate to be added to 100 mL of 0.1 M acetic acid solution [$pK_b(CH_3COO^-) = 9.26$] is :

(A) 0.05 mole (B) 0.025 mole (C) 0.1 mole (D) 0.005 mole

9. A 18 mL solution containing acetic acid and sodium acetate required 6 mL of 0.1 M NaOH for eutalization of the acid and 12 mL of 0.1 M HCl for reaction with salt, separately. If pK_a of the acid is 4.75, what is the pH of the initial mixture :

(A) 5.05 (B) 4.75 (C) 4.55 (D) 5.23

10. The pH of blood is 7.4. What is the ratio of $\frac{[HPO_4^{2-}]}{[H_2PO_4^-]}$ in the blood ? Given : K_{a1}, K_{a2} and K_{a3} for H_3PO_4 are 10^{-3}, 8×10^{-8} and 10^{-12} respectively.

(A) 2 : 1 (B) 1 : 2 (C) 3 : 1 (D) 1 : 3

11. When CO_2 dissolves in water, the following equilibrium is established :

$$CO_2 + 2H_2O \rightleftharpoons H_3O^+ + HCO_3^-$$

pH of solution is 5.9. The ratio of HCO_3^- to CO_2 would be :

(Given that K_{a1} & K_{a2} for H_2CO_3 are 4×10^{-7} and 4.8×10^{-11} respectively).

(A) 3.2 (B) 0.32 (C) 3.84×10^{-5} (D) 3.84×10^{-4}

12. Select the correct statement :

(A) Na_2HPO_3 is an acid salt.

(B) Water acts as a base, when ammonia is dissolved in it .

(C) All aqueous solutions, whether neutral, acidic or basic, contain both H^+ & OH^- ions.

(D) All of these

13. Does the pH of solution increases, decreases or remain same when you :

(a) add NH_4Cl(s) to 100 ml of 0.1 M NH_3 ? (b) add sodium acetate(s) to 50 ml of 0.015 M acetic acid ?

(c) add NaCl(s) to 25 ml of 0.1 M NaOH ?

(A) decreases, increases, decreases (B) increases, decreases, no change

(C) increases, decreases, increases (D) decreases, increases, no change

14. Which of following solutions can act as buffer ?

(A) NaHS + Na_2S (B) $NaNO_3$ + HNO_3 (C) H_3PO_4 + NaH_2PO_4 (D) KCl + KOH

15. When 0.1 mole arsenic acid (H_3AsO_4) is dissolved in a 1L buffer solution of pH = 8. Which of the following options is/are correct ? For arsenic acid : $K_{a1} = 2.5 \times 10^{-4}$, $K_{a2} = 5 \times 10^{-8}$, $K_{a3} = 2 \times 10^{-13}$. ['<<' sign denotes that the high concentration is at least more than 100 times the lower one]

(A) $[H_3AsO_4] << [H_2AsO_4^-]$ (B) $[H_2AsO_4^-] << [HAsO_4^{2-}]$

(C) $[HAsO_4^{2-}] << [H_2AsO_4^-]$ (D) $[AsO_4^{3-}] << [HAsO_4^{2-}]$

16. Solutions of two weak acids HA and HB with K_{a_1} and K_{a_2} as their dissociation constants are mixed to have equal concentration of both in final solutions. Which of the following is correct, if $K_{a_1} > K_{a_2}$?

(A) $[H^+]$ from HA > $[H^+]$ from HB (B) α of HA > α of HB

(C) $[A^-] > [B^-]$ (D) [HA] > [HB]

17. Which of the following is an acid salt :

(A) Na_2SO_4 (B) Ca(OH)Cl (C) $Ca(H_2PO_2)_2$ (D) Na_2HPO_4

18. What is $[H^+]$ in mol/L of a solution that is 0.20 M in CH_3COONa and 0.10 M in CH_3COOH ? (K_a for $CH_3COOH = 1.8 \times 10^{-5}$)

(A) 3.5×10^{-4} (B) 1.1×10^{-5} (C) 1.8×10^{-4} (D) 9×10^{-6}

19. A certain buffer solution contains equal concentration of X^- and HX. The K_b for X^- is 1×10^{-10}. The pH of the buffer is :

(A) 4 (B) 7 (C) 10 (D) 14

20. Solution containing 0.1 N NH_4OH and 0.1 N NH_4Cl has pH = 9.25.Then find out pK_b of NH_4OH.

(A) 9.25 (B) 4.75 (C) 3.75 (D) 8.25

21. 1 L of a buffer solution contains one mole each of CH_3COOH & $(CH_3COO)_2Ba$. Which of the following options is correct ? (pK_a of CH_3COOH = 4.7)

(A) pH = 9 (B) pOH = 8.6 (C) pH = 4.7 (D) pOH = 9

22. What is the pH of the solution at half neutralization in the titration of 0.1 N CH_3COOH solution by 0.5 M KOH solution : (K_a of $CH_3COOH = 1.8 \times 10^{-5}$)

(A) 4.74 (B) 9.26 (C) 4.26 (D) None of these

23. The total number of different kind of buffers obtained during the titration of H_3PO_4 with NaOH are :

(A) 3 (B) 1 (C) 2 (D) No buffer is obtained

24. The rapid change of pH near the stoichiometric point of an acid-base titration is the basis of indicator detection. pH of the solution is related to ratio of concentration of conjugate acid (HIn) and the base (In^-) forms of the indicator by the expression :

(A) $\log \frac{[In^-]}{[HIn]} = pK_{In} - pH$ (B) $\log \frac{[HIn]}{[In^-]} = pK_{In} - pOH$

(C) $\log \frac{[HIn]}{[In^-]} = pH - pK_{In}$ (D) $\log \frac{[In^-]}{[HIn]} = pH - pK_{In}$

25. Which of the following indicators is best suited in the titration of a weak acid versus a strong base ?

(A) phenolpthalein (8.3 – 10.0) (B) methyl orange (3.1 – 4.4)

(C) methyl red (4.2 – 6.3) (D) litmus (4.5 – 8.3)

26. Which of the following indicators is best suited in the titration of a weak base versus a strong acid ?

(A) phenolphthalein (8.3 – 10.0) (B) phenol red (6.8 – 8.4)

(C) methyl organe (3.1 – 4.4) (D) litmus (4.5 – 8.3)

27. For the acid H_2X, $pK_{a_1} = 4$ and $pK_{a_2} = 10$. Which of the following indicators (with their ranges provided) is most suitable for the titration $H_2X + OH^- \longrightarrow HX^- + H_2O$?

(A) Methyl orange (3.1 to 4.4) (B) Bromocresol green (3.8 to 5.4)

(C) p-nitrophenol (5.6 to 7.6) (D) Phenolphthalein (8 to 9.6)

RACE # 42

1.	(C)	**2.**	(B)	**3.**	(D)	**4.**	(B)	**5.**	(C)	**6.**	(D)	**7.**	(C)	**8.**	(B)	**9.**	(A)	**10.**	(A)
11.	(B)	**12.**	(C)	**13.**	(D)	**14.**	(AC)	**15.**	(AD)	**16.**	(ABC)			**17.**	(D)	**18.**	(D)	**19.**	(A)
20.	(B)	**21.**	(D)	**22.**	(A)	**23.**	(A)	**24.**	(D)	**25.**	(A)	**26.**	(C)	**27.**	(C)				